

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY


(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 31 MAR 2006

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Applicant's or agent's file reference P67537PC00		FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/NL2004/000876		International filing date (day/month/year) 16.12.2004	Priority date (day/month/year) 21.12.2003	
International Patent Classification (IPC) or national classification and IPC INV. C23C14/56 C23C16/30 C23C16/54 C23C16/513				
Applicant OTB GROUP B.V.				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 4 sheets, as follows:</p> <p style="margin-left: 40px;"><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p style="margin-left: 40px;"><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand 21.10.2005		Date of completion of this report 30.03.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized officer Ekhult, H Telephone No. +31 70 340-3561		



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/NL2004/000876

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

2-4, 6-13	as originally filed
1, 5	filed with telefax on 12.12.2005

Claims, Numbers

2-19, 21-35	as originally filed
1, 20	filed with telefax on 12.12.2005

Drawings, Sheets

1/3-3/3	as originally filed
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- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/NL2004/000876

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-35
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-35
Industrial applicability (IA)	Yes: Claims	1-35
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

- D5: PATENT ABSTRACTS OF JAPAN vol. 0153, no. 92 (C-0873), 4 October 1991
(1991-10-04) & JP 03 159992 A (FUJITSU LTD), 9 July 1991 (1991-07-09)
D6: US-B1-6 397 776 (IACOVANGELO CHARLES DOMINIC ET AL) 4 June 2002
(2002-06-04)

1. Industrial applicability.

The subject-matter of the present claims 1-35 finds its industrial application in the field of coating.

2. Inventive step.

2.1

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.

The document D5 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (abstract) a method for making a layer (5) on a substrate (4) using a DC plasma jet for deposition of a first material and, at the same time, deposition of a second material from a second deposition process.

The subject-matter of claim 1 therefore differs from this known D5 in that a DC plasma cascade source is used for the plasma. The subject-matter of claim 1 is therefore new. The problem to be solved by the present invention may therefore be regarded as finding an alternative plasma source providing high deposition rate, good uniformity and good stability during the deposition.

The solution proposed in claim 1 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons: Use of a DC plasma cascade source for the generation of plasma during coating is known from D6

(column 4 line 3 - column 5 line 40). The skilled person would therefore regard it as a normal alternative to use this kind of plasma source in the method described in document D5 in order to solve the problem posed.

2.2

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 20 does not involve an inventive step in the sense of Article 33(3) PCT.

The document D5 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (abstract) an apparatus provided with a DC plasma jet source, means for introduction of a first deposition material (2) into the plasma, substrate (4) positioning means (8) and a second deposition source (7) to deposit a second material at the same time as the first material is deposited.

The subject-matter of claim 1 therefore differs from this known D5 in that a DC plasma cascade source is used for the plasma. The subject-matter of claim 20 is therefore new. The problem to be solved by the present invention may therefore be regarded as finding an alternative plasma source providing high deposition rate, good uniformity and good stability during the deposition.

The solution proposed in claim 20 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons: Use of a DC plasma cascade source for the generation of plasma during coating is known from D6 (column 4 line 3 - column 5 line 40). The skilled person would therefore regard it as a normal alternative to use this kind of plasma source in the method described in document D5 in order to solve the problem posed.

3. Dependent claims 2-19, 21-35

Dependent claims 2-19, 21-35 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(2) and (3) PCT).

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Title: Method and apparatus for manufacturing a functional layer consisting of at least two components

The invention relates to a method for manufacturing a layer on a substrate with the aid of a PECVD source.

In practice, there sometimes is the need to build up layers from various materials. Here, it can be an advantage when the materials are
5 mixed with one another within the layer. The present invention contemplates providing a method and an apparatus with which such composite layers can be manufactured.

According to the invention, a method for manufacturing a functional layer is provided, where a substrate is introduced into a process chamber,
10 where at least one plasma is generated by at least one ^{Dc} ^{cascade} plasma source ~~/such as for instance a plasma cascade source/~~ where at least one deposition material is deposited on the substrate under the influence of the plasma, while, at the same time, at least one second material is applied to the substrate with the aid of a second deposition process, while the functional
15 layer has no catalytic function.

The plasma flowing from the plasma source preferably designed as a plasma cascade source usually has a relatively high outflow velocity, so that the plasma can accurately be aimed at the substrate in order to deposit the deposition material thereon. Further, the plasma makes precursors
20 sufficiently chemically active to bind to eventually form the functional layer. For this purpose, the pressure in the process chamber can be maintained relatively low in relation to the pressure in each source. Further, ions formed in the plasma may be accelerated towards a surface to be covered by, for instance, the plasma and/or a suitable electric field for the purpose of
25 deposition on that substrate. Due to the combination of the plasma source

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DC
least one plasma cascade source to generate at least one plasma, while the apparatus comprises means to introduce a first deposition material into each plasma, while the apparatus is further provided with substrate positioning means for bringing and/or keeping at least a part of a substrate in such a position in a process chamber that the substrate contacts the plasma, while the apparatus is provided with a second deposition source, which second deposition source is arranged to deposit at least one second deposition material on the substrate at the same time as the plasma cascade source, while the functional layer is no catalytically active layer.

10 With this apparatus, functional layers consisting of different material can be manufactured relatively fast and with a high uniformity over a large surface. Here, use of the plasma cascade source offers the above-mentioned advantages.

Further elaborations of the invention are described in the subclaims.
15 The invention will now be explained on the basis of two exemplary embodiments and with reference to the drawing, in which:

Fig. 1 shows a diagrammatic cross-sectional view of a first exemplary embodiment of an apparatus for manufacturing a functional layer consisting of two or more materials;

20 Fig. 2 shows a detail of the cross-sectional view shown in Fig. 1, in which the plasma cascade source is shown; and

Fig. 3 shows a second exemplary embodiment of the invention.

Figs. 1 and 2 show an apparatus for manufacturing a functional layer containing two or more materials. The apparatus shown in Figs. 1 and 2 is provided with a PECVD process chamber 2 on which a DC (direct current) plasma cascade source 3 has been provided. The DC plasma cascade source 3 is arranged to generate a plasma P with DC voltage. The apparatus is provided with a substrate holder 8 to keep one substrate 1 opposite an outflow opening 4 of the plasma source 3 in the process chamber 2.

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CLAIMS

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1. A method for manufacturing a functional layer, wherein a substrate (1; 101) is introduced into a process chamber (2; 102), wherein at least one plasma (P) is generated by at least one ^{DC} ^{cascade} plasma source (3; 103), ~~such as for instance a plasma cascade source~~, wherein at least one
- 5 deposition material (A) is deposited on the substrate (1; 101) under the influence of the plasma (P), wherein, at the same time, at least one second material (B) is applied to the substrate with the aid of a second deposition process, wherein the functional layer has no catalytic function.
2. A method according to claim 1, wherein the said first deposition
- 10 material (A) is supplied to the plasma (P) outside the at least one plasma source (3; 103) in the process chamber (2; 102).
3. A method according to claim 1 or 2, wherein at least one volatile compound of the said first deposition material (A) is supplied to the plasma (P) for the purpose of the deposition.
- 15 4. A method according to claim 3, wherein the volatile compound contains at least one precursor material which decomposes the material to be deposited in the process chamber (2; 102) before the material has reached the substrate (1; 101).
5. A method according to any one of the preceding claims, wherein the
- 20 second deposition process has been chosen from the group comprising PECVD, CVD, PVD, such as sputtering, hollow-cathode sputtering, vapor deposition optionally using boats, e-beam, and optionally supported by an ion process, ion plating, microwave deposition, ICP (inductive coupled plasma), parallel-plate PECVD, optionally honey comb electrode structures,
- 25 and the like.
6. A method according to any one of the preceding claims, wherein at least one sputtering electrode (6) comprising the said deposition

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16. A method according to at least claim 1, wherein the substrate (1; 101) is substantially porous.

17. A method according to any one of the preceding claims, wherein the deposition material (A, B) is deposited such that the chemical composition of the deposited material measured over distances of 5 cm, preferably over a distance of 10 cm, more particularly over a distance of 20 cm, differs by less than 10%, particularly less than 5% and more particularly less than 1%.

18. A method according to any one of the preceding claims, wherein the substrate (1; 101) is adjusted to a particular electrical potential, for instance by DC, pulsed DC and/or RF biasing.

19. A method according to any one of the preceding claims, wherein the substrate (1; 101) is adjusted to a particular treatment temperature.

20. An apparatus for manufacturing a functional layer on a substrate, wherein the apparatus is provided with at least one ^{DC cascade} plasma source (3; 103) ~~such as for instance a plasma cascade source~~ to generate at least one plasma (P), wherein the apparatus comprises means (6, 7) for introducing a first deposition material (A) into each plasma (P), wherein the apparatus is further provided with substrate positioning means (8; 118) for bringing and/or keeping at least a part of a substrate (1; 101) in such a position in a process chamber (2; 102) that the substrate (1; 101) contacts said plasma (P), wherein the apparatus is provided with a second deposition source, which second deposition source is arranged to deposit at least one second deposition material (B) on the substrate (1; 101) at the same time as the plasma source, wherein the functional layer is no catalytically active layer.

21. An apparatus according to claim 20, wherein the second deposition source is a VD source, such as for instance a CVD source, a PVD source, a PECVD source.

22. An apparatus according to claim 20 or 21, wherein the second deposition source is arranged for carrying out one of the following deposition